



## Seaweed based antioxidants – analysis and application

Hermund, Ditte Baun; Jonsdottir, Rosa; Kristinsson, Hordur G.; Nielsen, K. F.; Jacobsen, Charlotte

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# “Seaweed based antioxidants – analysis and application”

Hermund DB<sup>a</sup>, Jónsdóttir R<sup>b</sup>, Kristinsson HG<sup>b</sup>, Nielsen KF<sup>c</sup>, Jacobsen C<sup>a</sup>

<sup>a</sup> National Food Institute, Technical University of Denmark, DK-2800 Kgs. Lyngby, Denmark; corresponding author:

dbala@food.dtu.dk

<sup>b</sup> Matís, Reykjavik, Iceland

The overall aim of this work was to develop novel seaweed based antioxidants. The objectives were to extract, identify and characterizing the phlorotannins from Nordic brown algae *Fucus vesiculosus* and furthermore evaluate *F. vesiculosus* extracts in different food and cosmetic o/w emulsions.

Extracts from Icelandic *F. vesiculosus* were conducted using ethanol, acetone, ethyl acetate and water. The antioxidant properties were evaluated *in vitro* by antioxidant assays. Furthermore, the extracts were characterized based on composition of bioactive compounds influencing the antioxidant activity. Application of the extracts was evaluated in facial cream (20°C/dark or light, 40°C/dark), 5% fish-oil-enriched milk (5°C), mayonnaise (20°C) and granola bars (20°C). Addition of fish oil increased lipid oxidation due to the high content of n-3 long chain polyunsaturated fatty acids (PUFA) in fish oil. Hence, if the antioxidants showed high effectiveness in these foods these could be suitable for any kind of lipid rich food with the same or lower amount of PUFAs. The oxidative stability was evaluated over time by determining different oxidation parameters, such as primary and secondary oxidation products. Additionally, pressurized liquid extraction (PLE) was evaluated as potential “green” extraction method to extract phlorotannins from *F. vesiculosus*. PLE extracts were conducted from Danish *F. vesiculosus*. The phenolic content and *in vitro* antioxidant properties were determined. The phlorotannins were identified and the antioxidant activity of specific compounds was determined using HPLC-DAD-ECD-DAD-qTOFMS. The results are not finalized. Results showed a large variety of bioactive compounds in the extracts both with potential antioxidant and/or prooxidant activity. All extracts exhibited high radical scavenging activity ( $\approx 100\%$ ) and moderate metal chelating ability (20-60%). In food application, increased lag phase of secondary oxidation products related to oxidation of fish oil was observed when extracts were added. High phenolic content was related to a high antioxidant efficacy in foods. In facial creams the extracts limited formation of pentanal during storage. Acetone extract was more efficient than water extract towards limiting formation of pentanal. Elevated temperatures caused unstable emulsions and syneresis. Furthermore, creams changed color from white to more red/brown at all storage conditions.

**My name is Ditte B. Hermund. I am a food scientist and PhD student at the National Food Institute. The work title of my PhD study is “Extraction and characterization of highly bioactive ingredients from Nordic marine algae”. The study is part of the project “Novel bioactive seaweed based ingredients and products” financed by Nordic Innovation and is in collaboration with Mátis in Iceland as part of work package 2 “Characterization of ingredients”. The aim is to develop new natural antioxidants from Nordic seaweed resources by research of antioxidative phenolic secondary metabolites of brown algae *Fucus vesiculosus*.**

